Recovery Rates for External Anchor Tags in British Columbia Herring Fisheries

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RECOVERY RATES FOR EXTERNAL ANCHOR TAGS IN BRITISH COLUMBIA HERRING FISHERIES

by

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ABSTRACT

Haegele, C. W. 1983. Recovery rates for external anchor tags in British Columbia herring fisheries. Can. MS Rep. Fish. Aquat. Sci. 1745: iii + 9 p.

Approximately 35% of external anchor tags are recovered from catches in herring fisheries in British Columbia. The recovery rates are similar for the two major fisheries; roe, food and bait. Recovery rates vary among processing plants and this may be attributed to physical conditions within plants and worker and management enthusiasm in returning of tags. Orange and pink tags have higher recovery rates than yellow, white or green tags. In the design of a tagging program, the recovery rates must be considered if quantitative estimates of stock size and mixing are to be made.

Key words: external tags, recovery rate, Pacific herring

RÉSUMÉ

Haegele, C. W. 1983. Recovery rates for external anchor tags in British Columbia herring fisheries. Can. MS Rep. Fish. Aquat. Sci. 1745: iii + 9 p.

Environ 35% des étiquettes externes à ancrage sont récupérées sur des harengs capturés en Colombie-Britannique. Les taux de récupération sont semblables pour les deux principales pêches, soit la pêche du hareng plein et la pêche du hareng de consommation ou d'appât. Ils varient en fonction de l'usine de transformation, probablement à cause des conditions physiques qui y prévalent ainsi que de l'empressement des travailleurs et des gestionnaires à retourner les étiquettes. Les étiquettes de couleur rose et de couleur orange font l'objet d'un taux plus élevé de récupération que les jaunes, les blanches ou les vertes. On doit tenir compte des taux de récupération des étiquettes dans la conception de programmes d'étiquetage s'il faut réaliser des estimations quantitatives de la taille et du mélange des stocks.

Mots-clés: étiquettes externes, taux de récupération, hareng du Pacifique.

INTRODUCTION

Since 1979 British Columbia herring have been tagged to investigate stock discreteness, migrations and abundance (Haegele et al. 1983). External anchor tags were selected because of their relative ease of insertion and their potentially high visibility in the roe fishery where fish are individually handled for roe extraction.

Ideally a tagging program should be able to estimate all important factors affecting tag recovery. Hay (1981) estimated anchor tag loss in herring due to shedding at 0.25 over one year and cautioned that tagging may produce some mortality, which he was unable to quantify. In tag recovery trials for herring processed for food and bait, recovery rates for tags in the catch were estimated at 0.35 and about 0.25 of tags may have been lost during transfer of the catch by pumps, with the remainder not being seen or returned by processing plant workers (Haegele 1982). In a pilot tag recovery trial involving processing of roe herring at a major B.C. processing plant, 0.84 of tags were recovered (Hay and Mitchell 1979). However, this plant had one of the highest recovery rates during the food fishery tag recovery trials (0.59), and the 0.84 recovery rate may not be a good estimate for the industry at large. Therefore, further tag recovery trials were conducted during the 1983 herring roe fishery. Additional tag recovery trials were conducted during the 1982 food fishery in the lower Strait of Georgia to obtain a fishery-specific recovery rate for use in the mark-recapture stock estimates.

As well, experiments were initiated in 1982 to determine if tag colour affects the survival of tagged herring released in the wild through differential predation (Haegele et al. 1983). To be able to separate this effect from the effect of the visibility of a tag to processing plant workers, the plant recovery rates for the different colours must be known. Some preliminary work evaluated recovery rates for 3 tag colours in fish processed for food (Hay et al. 1979). In the experiments described in this report, the recovery rates for 6 colours were determined for the roe fishery.

METHODS

Herring were tagged with "long" Floy anchor tags in the 1982 food fishery and "short" Floy anchor tags in the 1983 roe fishery tag recovery trials. Tags and tagging methods are described in Haegele et al. (1983). Tag recoveries were made by processing plant personnel. The tagging program was advertised with posters in the processing plants and technical personnel from the Pacific Biological Station visited processing plants during periods when herring were being handled. They retrieved tags from finders and encouraged plant employees to turn in recovered tags. Returned tags were entered in a prize draw to further encourage reporting.

1982 FOOD FISHERY

There were three fishery openings during the 1982 food fishery in the lower Strait of Georgia. Tagged fish were introduced into the seine with the catch for 2 vessels during the first opening, 3 vessels during the second opening and 1 vessel during the third opening. The catches were pumped from the seine to the hold of the vessels, unloaded by pump at the processing plant, and the catch sorted, boxed and frozen. Tags are generally recovered only to the boxing stage. If the catch is further processed locally (eg. for human consumption), further recoveries may be made. All tags used in these trials were coloured international orange.

1983 ROE FISHERY

During the 1983 roe fishery, catches made by seine and gillnet were salted with tags. Six colours of tags were used in paired trials. For seine catches it was planned that the charter payment catches, totalling 1490 tons, made by the 12 test vessels would be salted with tags, providing at least 24 paired trials. However, only 7 sets made by 4 vessels (13 trials) were salted with tags. The catches were pumped from the seine to the packer vessel holds and unloaded from there by pump at the processing plant.

Catches made by gillnets were salted with tags during the 1983 Lambert Channel roe fishery. It is not possible to release tagged fish into the gillnet to estimate the rate of tag recovery from capture to processing. Hence any tag loss attributable to shaking the fish from the gillnets cannot be estimated directly. However, gillnet herring catches are mostly off-loaded from gillnet punts to packer vessels and it was at this stage of catch handling that the tag recovery trials were initiated. Packer vessels whose loads were salted during the trials had an average capacity of 45 (S.D. = 16) tons and 25 tags of each of 2 colours were introduced with the catch into the holds. There were 20 paired trials. The catches were unloaded by pump at the processing plant.

Herring catches are generally frozen prior to final processing (i.e. "roe popping") and tags are recovered at all stages of catch handling but the majority of the tags are recovered during the "roe popping".

RESULTS

1982 FOOD FISHERY

There were 6 tag recovery trials during the 1982 food fishery and 149 tags were salted into the catches. There were 78 tags recovered (Table 1). The recovery rates for individual trials ranged from 0.320 to 0.680 and averaged 0.524 (S.D. = 0.136).

1983 ROE FISHERY

There were 33 individual tag recovery trials during the 1983 roe fishery on 17 catches or loads and 847 tagged fish were used; the tags from 223 of these were recovered (Table 2). Recovery rates for trials ranged from 0.000 to 0.880. Because fewer than anticipated seine catches were salted with tags there were only 4 or 5 separate trials for 5 of the 6 colours (Table 3). The 3 "reddish" coloured tags (international orange, pink and orange) had the highest recovery rates and in the 11 trials where tags from this group were paired with green, yellow or white tags,they always had the higher recovery rate. In these 11 paired trials the average (±1 S.D.) recovery rate for "reddish" tags was 0.368 (±0.250) and for other coloured tags it was 0.141 (±0.171). For all the trials, the "reddish" coloured tags had an average recovery rate of 0.341 (±0.232); other coloured tags had an average recovery rate of 0.209 (+0.257) (Table 4). Recoveries for international orange tags were significantly higher (χ^2 test) than for all other colours except pink, and white tags had lower recoveries than all other coloured tags (Table 4). Recoveries for pink, orange, and green tags were not significantly different from each other. Yellow tags had lower recoveries than international orange and pink tags.

DISCUSSION

The recovery rates for "reddish" coloured tags in the catch was found to be similar for herring processed for roe or for food and bait at approximately 0.35. The lower recovery rates for other coloured tags were most likely the result of their reduced visibility. The darker, green tags were obviously difficult to see when lighting was poor and white tags may have been mistaken for extruded milt. The reason for yellow tags not having high visibility remains unexplained.

The 0.836 recovery rate in a single trial obtained by Hay and Mitchell (1979) during processing for roe appears to be a maximal recovery rate that could be expected when herring are tagged from catches as they enter a processing plant. However, such a rate is not applicable to fish tagged before or during a fishery. The 1982 food fishery recovery rate was the highest of the 3 fisheries for which multiple tag recovery trials have been conducted (Table 5). It is suspected that the relatively small catch in this fishery (1354 tons) which was processed by only a few of the plants normally processing herring contributed to this high recovery rate.

The results from the 1983 roe fishery tag recovery trials appear to confirm the conclusion drawn for the 1981 food fishery tag recovery trials (Haegele 1982) that recovery rates vary among plants and depend on physical

conditions within plants and on worker and management enthusiasm in returning tags (Table 6). The observations by technical personnel who visited plants to obtain recovered tags are in agreement with this conclusion.

The recovery rate for tags must be considered in tagging program design. When making mark-recapture stock estimates or quantitative estimates of stock mixing from external anchor tag recoveries in B.C. herring fisheries, it would be advisable to obtain fishery specific and possibly plant specific recovery rates for each of the tag colours used.

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Table 1. Tag release and recovery information for 1982 herring food fishery tag recovery trials.

Fishery opening	Planta	No. of tags	
		Released	Recovered
First	JSMF	24	14
Third	JSMF	25	12
First	LOBS	25	17
Second	LOBS	25	16
Second	NSPL	25	11
Second	SPET	25	8
All		149	78

[a]For full names of processing plants, referred to by the four letter code, see Appendix table 1.

Table 2. Number of tags released and recovered for paired tag recovery trials in the 1983 herring roe fishery.

		Tag colour											
		Int Orange		Pink		Orange		Green		Yellow		White	
Plant[a]	Gear	Rel	Rec	Rel	Rec	Rel	Rec	Rel	Rec	Rel	Rec	Rel	Rec
AERT	GN							25	13			23	2
BCPL	GN			25	18			25	14				
BCPL	GN					25	17	25	8				
BECF	GN					25	3	24	1				
CFCL[b]	SN	41	13							41	2		
CFCL	GN			25	9							25	5
CNFB	SN	25	8					25	3				
CNFB	SN	25	6					25	4				
KIEL	GN			25	10	25	4						
OCFL	SN	25	19							20	2		
PPSL	GN					25	3					25	0
PRFR	SN							27	2	25	3		
PRFR	SN							25	0	25	2		
PTCL	GN			24	1			24	0				
QFCL[c]	SN			25	4								
QFCL	GN					25	8					25	0
WPFL	GN							25	22	23	15		
ALL	SN	116	48	25	4	-	-	102	9	111	9	-	-
	GN	-	-	99	38	125	35	148	58	23	15	98	7
	ALL	116	48	124	42	125	35	250	67	134	24	98	7

[a]For full names of processing plants, referred to by the four letter code, see Appendix table 1.

[b]Catch processed in 4 plants (47% of tags recovered at CFCL).

[c]Single trial.

Table 3. Recovery rates, by tag colour, for 1983 herring roe fishery tag recovery trials.

Tag colour	No. of trials	Recovery rate	
		Average	S.D.
Int. orange	4	0.421	0.232
Pink	5	0.336	0.260
Orange	5	0.280	0.238
Green	10	0.268	0.297
Yellow	5	0.200	0.254
White	4	0.072	0.095

Table 4. Significant differences (P=0.01, P=0.05, or N.S.) in recoveries between colours in the 1983 roe fishery tag recovery trials (x^2 test).

	Int. orange	Pink	Orange	Green	Yellow	White
Int. orange	-	N.S.	0.05	0.01	0.01	0.01
Pink	N.S.	-	N.S.	N.S.	0.01	0.01
Orange	0.05	N.S.	-	N.S.	N.S.	0.01
Green	0.01	N.S.	N.S.	-	N.S.	0.01
Yellow	0.01	0.01	N.S.	N.S.	-	0.05
White	0.01	0.01	0.01	0.01	0.05	-

Table 5. Tag recovery rates for 1981-1983 tag recovery trials.

	1981 Food[a]	1982 Food	1983 Roe		
Tag colours	I	I	I,P,O	G,Y,W	ALL
No. of trials	32	6	14	19	33
Recovery rate - Av	0.370	0.524	0.341	0.209	0.260
- S.D.	0.223	0.136	0.232	0.257	0.245

[a]From Haegele (1982).

Table 6. Summary of tag recovery rates in processing plants for recovery trials conducted since 1979.

	Fishery							
	1979 Roe[b]		1981 Food[c]		1982 Food		1983 Roe[d]	
Plant[a]	No. of trials	Recovery rate	No. of trials	Recovery rate	No. of trials	Recovery rate	No. of trials	Recovery rate
AERT			2	0.060				
BCPL	1	0.836	4	0.590			2	0.700
BECF							1	0.120
CFCL			5	0.448			2	0.364
CNFB							2	0.280
CPCL			3	0.095				
JSMF			3	0.413	2	0.531		
KIEL							2	0.280
LOBS					2	0.660		
MIFL			1	0.440				
NSPL			1	0.540	1	0.440		
OCFL			2	0.300			1	0.760
PPSL							1	0.120
PRFR			2	0.140				
PTCL							1	0.042
QFCL			3	0.667			2	0.240
SCEL			2	0.260				
SPET			3	0.427	1	0.320		
TOEL			1	0.120				

[a]For full names of processing plants referred to by the four letter code, see Appendix table 1.

[b]From Hay and Mitchell (1979).

[c]From Haegele (1982).

[d]For "reddish" coloured tags only.

Appendix table 1. List of processing plants referred to in Tables 1 to 5.

Code	Plant name and location
AERT	Aero Trading, Vancouver.
BCPL	B.C. Packers Ltd., Richmond.
BECF	Bella Coola Fisheries, Richmond.
CFCL	Canadian Fishing Co. Ltd., Vancouver.
CNFB	Central Native Fishermen's Co-op, Bella Bella.
CPCL	Cassiar Packing Co. Ltd., Richmond.
JSMF	J.S. McMillan Fisheries Ltd., Vancouver.
KIEL	Kingfisher Enterprises Ltd., Parksville.
LOBS	Long Beach Shellfish, Delta.
MIFL	Millerd Fisneries Ltd., North Vancouver.
NSPL	North Sea Products Ltd., Vancouver.
OCFL	Ocean Fisheries Ltd., Vancouver.
PPSL	Pacific Point Seafoods Ltd., Richmond.
PRFR	Prince Rupert Fishermen's Co-op, Prince Rupert.
PTCL	Pisces Trading Co. Ltd., Vancouver.
QFCL	Quality Fish Co. Ltd., Vancouver.
SCEL	Scanner Enterprises Ltd., Surrey.
SPET	Spetifore, Delta.
TOEL	Tonquin Enterprises Ltd., Vancouver.
WPFL	Westpine Fisheries Ltd., Vancouver.

POOR

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